CLAIMS

1. A method of forming a domain inverted region in a ferroelectric single crystal, said method comprising;

a step of forming a control layer having a larger defect density D_{contl} than the defect density D_{ferro} of said ferroelectric single crystal ($D_{ferro} < D_{contl}$) on a first face perpendicular to the direction of polarization of said ferroelectric single crystal in said ferroelectric single crystal,

a step of forming a first electrode on said control layer,

a step of forming a second electrode having a smaller area than the area of said first electrode on a second face being opposite to said first face of said ferroelectric single crystal, and

a step of applying an electric field between said first electrode and said second electrode, in which the spontaneous polarization possessed by a domain inverted region generated from said second electrode is terminated through said control layer at said first electrode side.

2. A method of forming a domain inverted region in a ferroelectric single crystal according to claim 1, wherein said ferroelectric single crystal is substantially stoichiometric lithium niobate or lithium tantalate.

3. A method of forming a domain inverted region in a ferroelectric single crystal according to claim 2, wherein said substantially stoichiometric lithium niobate or

lithium tantalate comprises an element of 0.1 to 3.0 mol%, said element being selected from a group consisting of Mg, Zn, Sc and In.

4. A method of forming a domain inverted region in a ferroelectric single crystal according to claim 1, wherein the step of forming said control layer comprises;

a step of depositing a metal layer selected from a group consisting of Nb, Ta, Ti, Si, Mn, Y, W and Mo on said first face, and

a step of annealing said metal layer.

5. A method of forming a domain inverted region in a ferroelectric single crystal according to claim 1, wherein the step of forming said control layer comprises a step of annealing said first face in an atmosphere selected from a group consisting of an inert atmosphere, an oxygen atmosphere and a vacuum atmosphere.

6. A method of forming a domain inverted region in a ferroelectric single crystal according to claim 1, said method further comprising a step of forming a further control layer including a first region and a second region on said second face, wherein the defect density of said second region is equal to the defect density D_{ferro} of said ferroelectric single crystal and the defect density D_{cont2} of said first region is larger than the defect density D_{ferro} of said second region ($D_{ferro} < D_{cont2}$).

7. A method of forming a domain inverted region in a ferroelectric single crystal according to claim 6, wherein

the step of forming said further control layer comprises;

a step of depositing a metal layer selected from a group consisting of Nb, Ta, Ti, Si, Mn, Y, W and Mo on said second face, and

a step of annealing said metal layer.

8. A method of forming a domain inverted region in a ferroelectric single crystal according to claim 6, wherein the step of forming said further control layer comprises a step of annealing said second face through a mask in an atmosphere selected from a group consisting of an inert atmosphere, an oxygen atmosphere and a vacuum atmosphere.

9. A method of forming a domain inverted region in a ferroelectric single crystal according to claim 1, wherein said first electrode is a flat electrode and said second electrode is a periodic electrode.

10. A method of forming a domain inverted region in a ferroelectric single crystal according to claim 1, said method further comprising a step of removing said first electrode, said second electrode and said control layer.

11. An optical wavelength conversion element manufactured by a method of forming a domain inverted region in a ferroelectric single crystal, said method comprising;

a step of forming a control layer having a larger defect density D_{contl} than the defect density D_{ferro} of said ferroelectric single crystal ($D_{ferro} < D_{contl}$) on a first face perpendicular to the direction of polarization of said ferroelectric single crystal in said ferroelectric

single crystal,

a step of forming a flat electrode on said control layer,

a step of forming a periodic electrode on a second face being opposite to said first face of said ferroelectric single crystal, and

a step of applying an electric field between said flat electrode and said periodic electrode, in which the spontaneous polarization possessed by a domain inverted region generated from said periodic electrode is terminated through said control layer at said flat electrode side.

12. An optical wavelength conversion element according to claim 11, wherein said ferroelectric single crystal is substantially stoichiometric lithium niobate or lithium tantalate.

13. An optical wavelength conversion element according to claim 12, wherein said substantially stoichiometric lithium niobate or lithium tantalate comprises an element of 0.1 to 3.0 mol%, said element being selected from a group consisting of Mg, Zn, Sc and In.

14. An optical wavelength conversion element according to claim 11, wherein said method further comprises a step of removing said control layer, said flat electrode and said periodic electrode.

15. A method of forming a domain inverted region in a ferroelectric single crystal, said method comprising;

a step of forming a control layer having a lower degree of order of lattice points than the degree of order of lattice points of said ferroelectric single crystal on a first face perpendicular to the direction of polarization of said ferroelectric single crystal in said ferroelectric single crystal,

a step of forming a first electrode on said control layer,

a step of forming a second electrode having a smaller area than the area of said first electrode on a second face being opposite to said first face of said ferroelectric single crystal, and

a step of applying an electric field between said first electrode and said second electrode, in which the spontaneous polarization possessed by a domain inverted region generated from said second electrode side is terminated through said control layer at said first electrode side.

16. A method of forming a domain inverted region in a ferroelectric single crystal according to claim 15, wherein said ferroelectric single crystal is substantially stoichiometric lithium niobate or lithium tantalate.

17. A method of forming a domain inverted region in a ferroelectric single crystal according to claim 16, wherein said substantially stoichiometric lithium niobate or lithium tantalate comprises an element of 0.1 to 3.0 mol%, said element being selected from a group consisting

of Mg, Zn, Sc and In.

18. A method of forming a domain inverted region in a ferroelectric single crystal according to claim 15, wherein the step of forming said control layer comprises a step of implanting ions selected from a group consisting of rare gases, Zn, Nb and Mn into said first face.

19. A method of forming a domain inverted region in a ferroelectric single crystal according to claim 15, said method further comprising a step of forming a further control layer including a first region and a second region on said second face, wherein the degree of order of lattice points of said second region is equal to the degree of order of lattice points of said ferroelectric single crystal and the degree of order of lattice points of said first region is lower in comparison with the degree of order of lattice points of said second region.

20. A method of forming a domain inverted region in a ferroelectric single crystal according to claim 19, wherein the step of forming said further control layer comprises a step of implanting ions selected from a group consisting of rare gases, Zn, Nb and Mn into said second face through a mask.

21. A method of forming a domain inverted region in a ferroelectric single crystal according to claim 15, wherein said first electrode is a flat electrode and said second electrode is a periodic electrode.

22. A method of forming a domain inverted region in a

ferroelectric single crystal according to claim 15, said method further comprising a step of removing said first electrode, said second electrode and said control layer.

23. An optical wavelength conversion element manufactured by a method of forming a domain inverted region in a ferroelectric single crystal, said method comprising;

a step of forming a control layer having a lower degree of order of lattice points than the degree of order of lattice points of said ferroelectric single crystal on a first face perpendicular to the direction of polarization of said ferroelectric single crystal in said ferroelectric single crystal,

a step of forming a flat electrode on said control layer,

a step of forming a periodic electrode on a second face being opposite to said first face of said ferroelectric single crystal, and

a step of applying an electric field between said flat electrode and said periodic electrode, in which the spontaneous polarization possessed by a domain inverted region generated from said periodic electrode side is terminated through said control layer at said flat electrode side.

24. An optical wavelength conversion element according to claim 23, wherein said ferroelectric single crystal is substantially stoichiometric lithium niobate or lithium tantalate.

25. An optical wavelength conversion element according to claim 24, wherein said substantially stoichiometric lithium niobate or lithium tantalate comprises an element of 0.1 to 3.0 mol%, said element being selected from a group consisting of Mg, Zn, Sc and In.

26. An optical wavelength conversion element according to claim 23, wherein said method further comprises a step of removing said control layer, said flat electrode and said periodic electrode.